ORDER NO. SD7702-1182

Service Manual

Direct drive automatic Turntable System

SL-1600 (M, MC)

Specifications

Specifications are subject to change without notice for further improvement.
Weights and dimensions shown are approximate.

Turntable section

Type:	Direct Drive Automatic Turntable System, Automatic start, Automatic return, Automatic shut-off and MEMO-REPEAT play Manual play
Drive method:	Direct Drive
Motor:	Back Electromotive Force Frequency Generator servo DC motor employing one chip IC
Turntable platter:	Aluminum die-cast, 33 cm (13")
Turntable speeds:	33-1/3 and 45 r.p.m.
Pitch controls:	Individual adjustment controls. 10% adjustment range
Wow and flutter:	0.025% W.R.M.S (JIS C5521) ±0.035% Weighted zero to peak (DIN 45507)
Rumble:	−50 dB (DIN 45539A) −73 dB (DIN 45539B)

Tonearm section

Type:	Universal tubular arm, staticbalanced type
Effective length:	230 mm (9-1/16',)
Overhang:	15 mm (19/32")
Friction:	7 mg (horizontally and vertically)
Effective mass:	22 g (6.0 g cartridge weight 1.75 g stylus pressure)
Tracking error angle:	Within +3° (at the point of 145 mm (5-45164") from the center within +1° (at the point of 55 mm (2-3/16") from the center
Offset angle:	21.5°
Adjustable stylus pressure range:	0 to 3 g (stylus pressure direct reading type)
Cartridge weight range:	5 to 11 g
Head shell weight:	9.5 g

General

Power supply:	AC 120 V, 50 or 60 Hz
Power consumption:	6 W
Dimensions: (H x W x D)	12.5 x 45.3 x 36.9 cm 14-15/16 x 17-12/16 x 14-9/16 inches)
Wegiht:	9.0 kg (19.8 ibs.)

Technics by Panasonic

Panasonic Company
Division of Matsushita Electric
Corporation of America
One Panasonic Way, Secaucus,
New Jersey 07094

Matsushita Electric of Hawaii, Inc.
320 Waiakamilo Road, Honolulu,
Hawaii 96817

Matsushita Electric of Canada Ltd.
40 Ronson Drive, Rexdale,
Ontario, Canada M9W 1B5

■ Parts identification

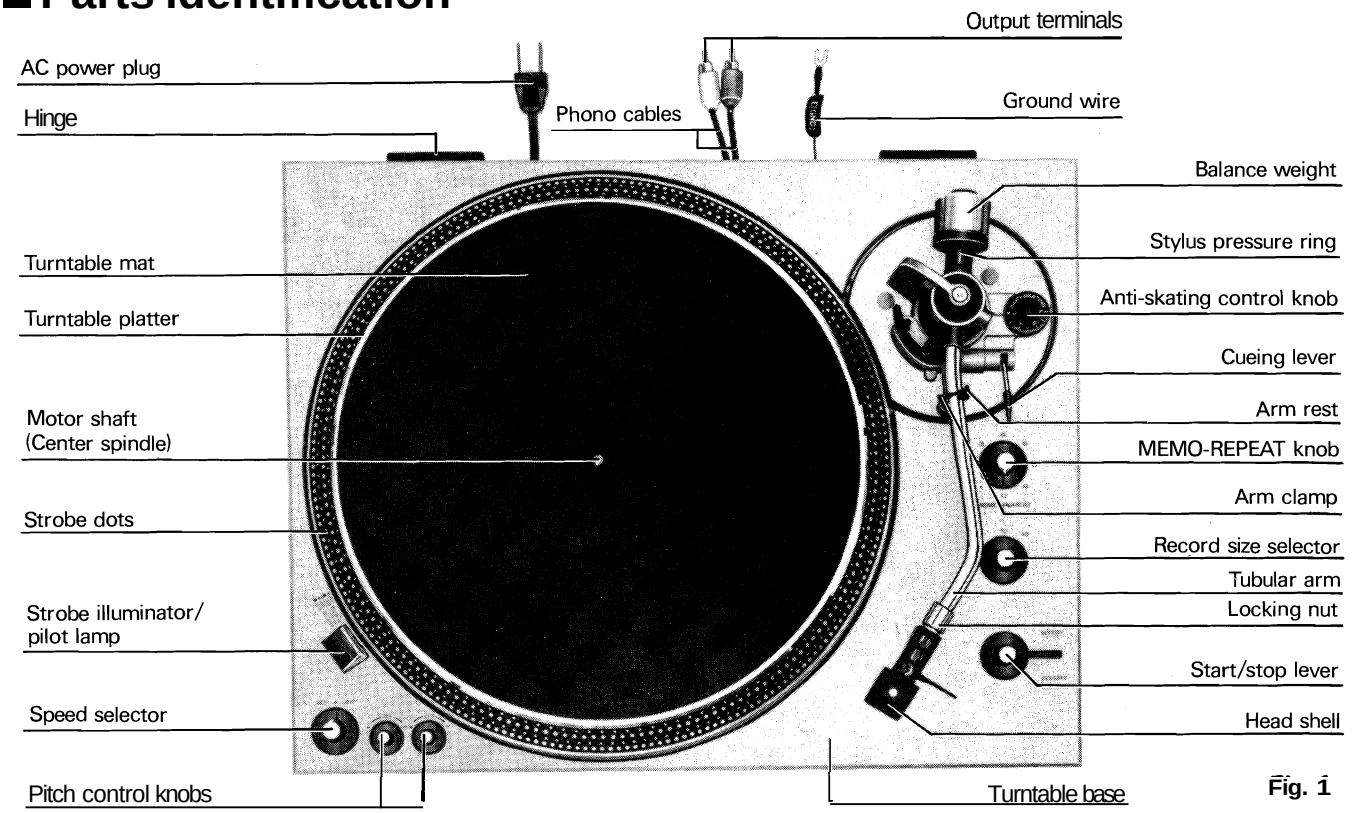


Fig. 1

■ Assembly and set-up

Apply two or three drops of oil to the motor shaft using the furnished oil container. (See Fig. 2)

Although the unit has been lubricated before shipping from the factory, apply a few drops of oil to the motor shaft for assurance. After that, application of two or three drops of oil once every *2000* hours' operation or so is sufficient. The time interval is much longer than that of the former type motors *(200 - 500* hours), so do not apply too much oil, nor more frequently than necessary. Never use any other type of oil.

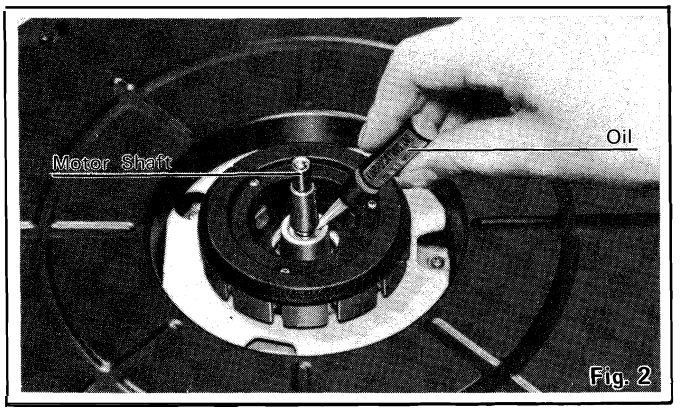


Fig. 2

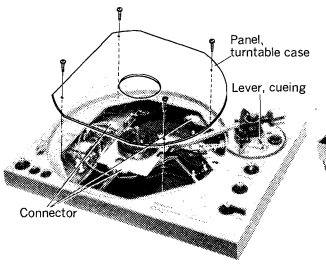
1. Remove the cartrige.
2. Fix the tone arm to the arm rest.
3. Remove the turntable.
4. Turn the player set upside down with good care not to damage the acryl cover.
5. Take off 4 vis-screws from the back panel.
6. Place the player set face upward holding it with both hands so that the body is not separated from the main body.

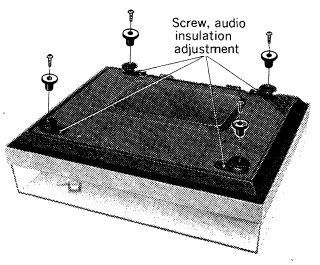
(1) For removal of the cover, take off 4 vis-screws from the panel cover.
(2) Draw out three connectors.
(3) For separation of the body from the main base, turn the cueing lever upward, move the tone-arm in inboard direction, then lift up the body.

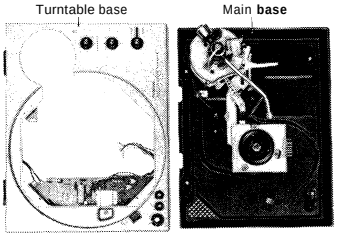
Note:

The turntable horizontaliy to the panel face is already adjusted before shipment.

If deviated, correct it by means of the adjust screws using a 5mm box spanner.







■ Adjustments

Adjustment of the arm lift height (See Figs. 4 and 5)

The arm lift height (distance between the stylus tip and record surface when cueing lever is raised) has been adjusted at the factory before shipping to approximately 5 to 10 mm (3/16" to 25/64").

If the clearance becomes too narrow or too wide because of the physical size of the different cartridges on the market turn the adjustment screw clockwise or counterclockwise, at the same time pushing the arm lift down.

Clockwise ratation

—distance between the record and stylus tip is reduced.

Counterclockwise rotation

—distance between the record and stylus tip increases.

Note:

As the adjusting screw has a hexagon head, be sure to make the adjustment while depressing the arm lift.

Adjustments for automatic start and automatic return positions (See Fig. 6)

Should the tonearm not function correctly, make adjustments according to the follwing procedures.

Adjustment for t start position

F the rubber cap.)

In cases where the stylus i d outside of the record.

– Move clockwise.

In cases where the stylus tip descends onto halfway of a ecorded piece.

– Move counterclockwise

tm for automatic return posittion

(Remove turntable sheet.)

In cases where the tonearm ten to return befor the playing has finished.

– Move clockwise.

In cases where the tonearm fails to return after the last groove of the record.

– Move counterclockwise.

Speed adjustment (with pitch control knobs) (See Figs. 7.8 and 9)

Strobe dots are set on the tapered rim of the turntable platter according to the power frequency and the number of revolutions of the records. Make adjustment, referring to strobe dot indication. (See Fig. 7)

1. Set the speed selector to the number of revolutions to be adjusted. (See Fig. 8)
2. Release the arm clamp and raise the cueing lever
3. Move the tonearm to a slight extent towards the turntable platter.
   The strobe illuminator/pilot lamp will be lit for illuminating the strobe dots.
4. While turning the pitch control knobs either to "+" side or "—" side, adjust to such an extent that the strobe dots of the turntable look as if they were stationary.

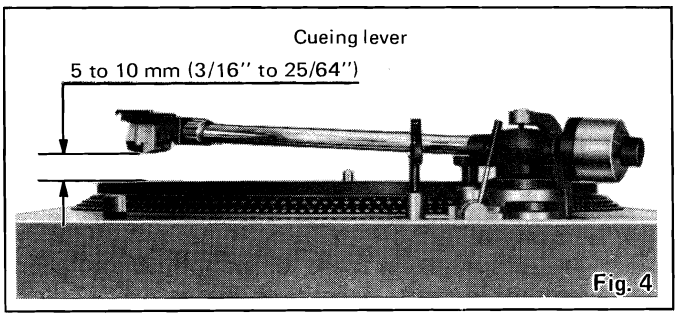


Fig. 4

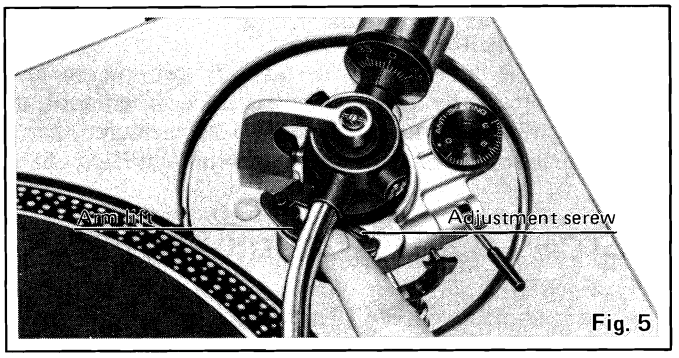


Fig. 5

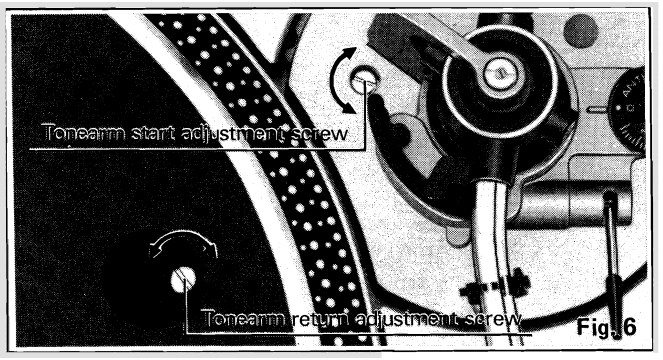


Fig. 6

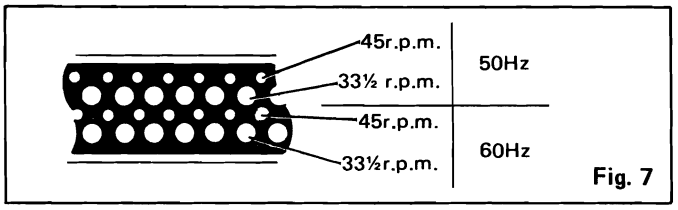


Fig. 7

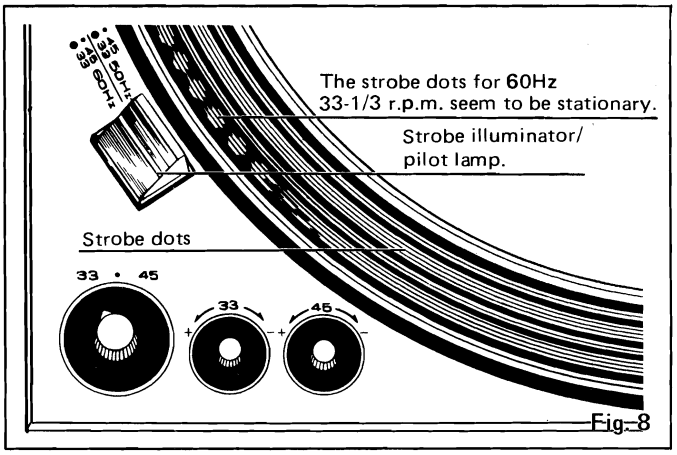


Fig. 8

The state under which the strobe dots seem to be stationary represents the correct number of revolutions.

"+" direction

This increases the speed of the turntable rotation, and the strobe dot pattern seems to flow in the same direction as the rotational direction of the turntable platter.

"–" direction

This decreases the speed of the turntable rotation, resulting in a state opposite to that in the "+" direction.

Note:

Strobe dot pattern.

The strobe illuminator/pilot lamp of this unit employs the commercially available power source. The frequency of such power source, when actually measured, has a fluctuation of about 0.2%. As such a fluctuation of the power source affects the strobe illuminator, the strobe dot pattern also seems to fluctuate to a certain extent.

But the unit is not affected by the fluctuations of the power source, since a D.C. motor is employed.

5. If the desired speed can not be obtained by the variable pitch controls, turn the speed adjusting screws with a screw driver for further adjustments. (See Fig. 9)

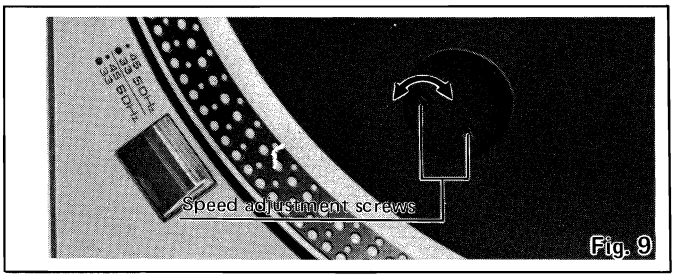
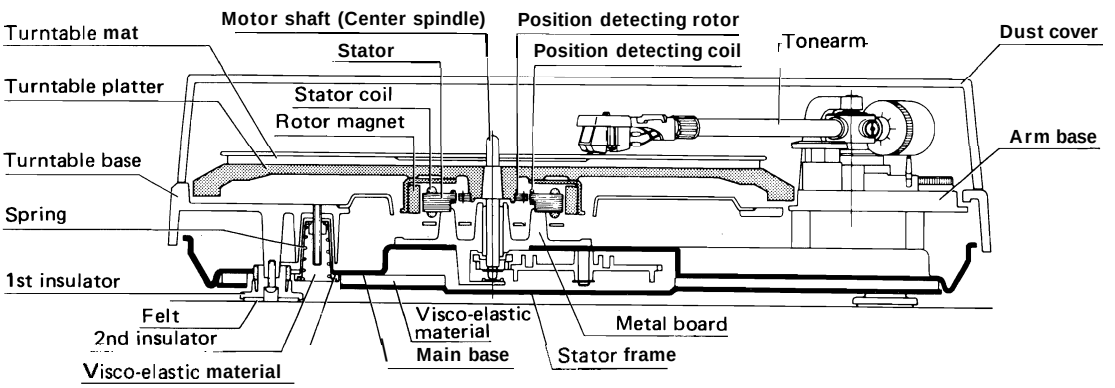


Fig. 9

■ Cross section of motor portion and double insulator



Operation principles of the SL-1600

This unit, like the SL 1300 has a rational motor structure, and its drive control circuit is the B.F.G. type (Back TECHNICAL EXPLANATION electromotive force frequency generator) which is constructed on a single integrated circuit (IC) chip (AN630). The following is a block diagram of the IC (AN630) for which the operating principle will be briefly explained

■ Operating principle

The back electromotive force, which is generated by the drive coil winding according to the rotation of the motor, is detected and converted to a frequency signal that is proportional to the numder of revolutions.

Conversion is performed by a wave-shaping circuit and a logic circuit (This is referred to as the B.F.G. method). This frequency signal is compared with a standard signal by means of a frequency-voltage conversion circuit which converts it to a voltage signal in order maintain a constant number of revolutions. After removing unnecessary frequency components, with the operational-amplifier active filter, from this voltage signal, it controls the current flow in three differential switching circuits. As a result, the flow of current in the drive coil winding is always constant maintaining the correct rotational speed. Control of the rotational speed can be performed by means of adjusting the standard signal generator circuit according to the rotational speed adjustment cricuit.

Explanation of each part

1. B.F.G. METHOD (BACK ELECTROMOTIVE FORCE FREQUENCY GENERATOR)

Making use of the back electromotive force that is generated in the drive coil winding of the motor as a frequency generator, the frequency of the frequency generator is converted to the number of revolutions for the turntable.
After shaping the wave form of this back electromotive force, it is composed logically, and a frequency is generated that is proportional to the number of revolutions. This is the use of the B.F.G. Making use of the drive coil winding, frequency generator coil windings and magnets are not necessary, yielding a motor structure that is very compact.

2. FREOUENCY-VOLTAGE CONVERSION CIRCUIT

Being composed of a trapezoldal wave generating circult. a pulse generating circuit and a sampling integration circuit, the B.F.G. output frequency is converted to a voltage, and control output voltage is generated in order to maintain the rotational speed of the turntable at a constant level.

3. OPERATION CONTROL CIRCUIT

The operation control circuit functions as a control output voltage control keeping the rotational speed of the turntable constant with regard to the start of turntable operation and the operation of the mechanism. With this circuit, transient response characteristics and starting characteristics are very good.

4. OPERATIONAL AMPLIFIER (OP AMP) ACTIVE FILTER

Because of using an operational amplifier in the active filter, an ideal filter operation is possible.
As a result, such high performance as a signal-to-noise (SN) ratio of 60 dB (IEC-B) and a wow-and-flutter level of 0.03%(WRMS) have been achieved.

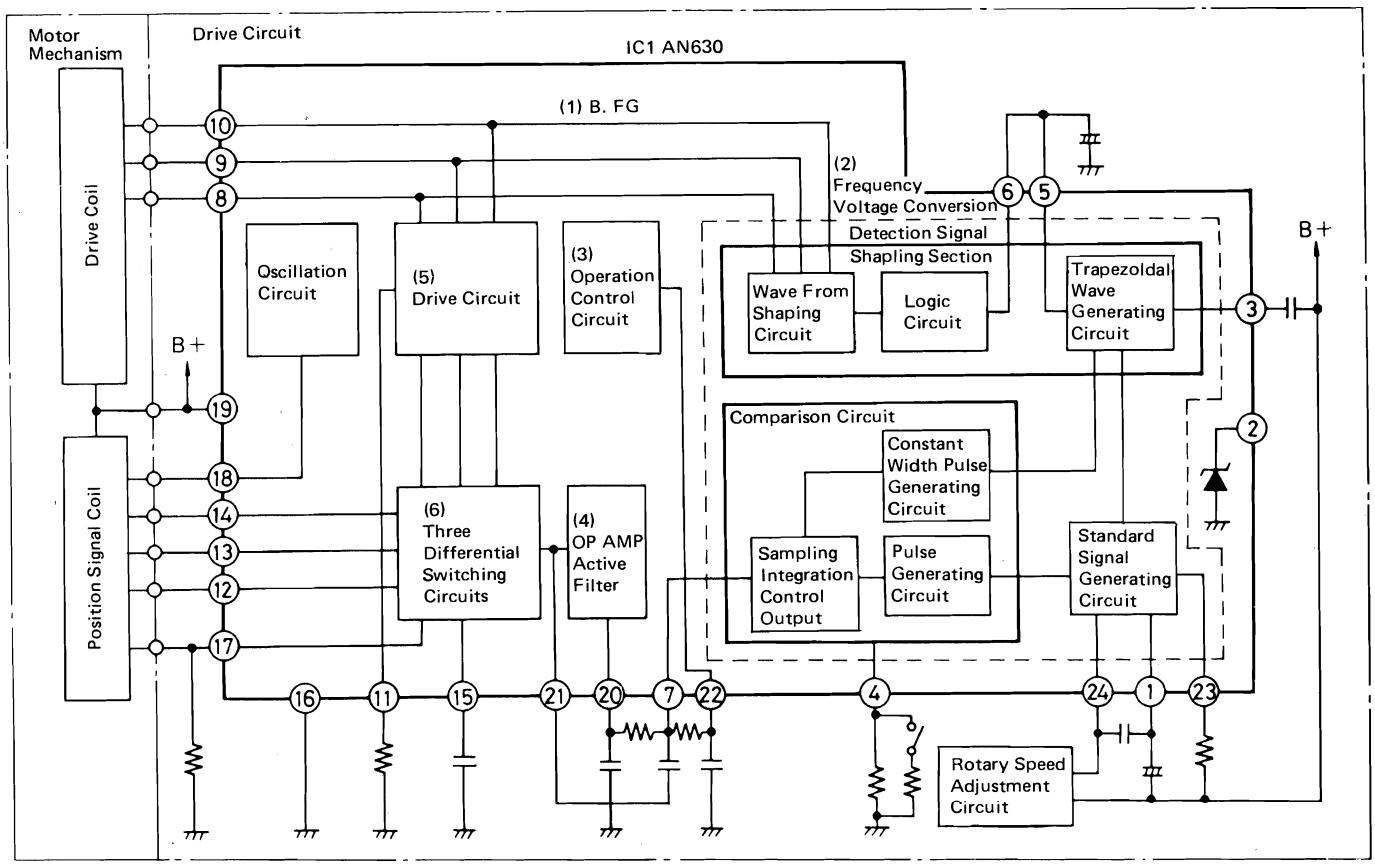
5. DRIVE CIRCUIT

By incorporating a large copacity power transistor in the integrated circuit, a starting torque of 1 kg-cm can be obtained. By means of this large starting torgue, prompt starts have been realized.

6. THREE DIFFERENTIAL SWITCHING CIRCUITS

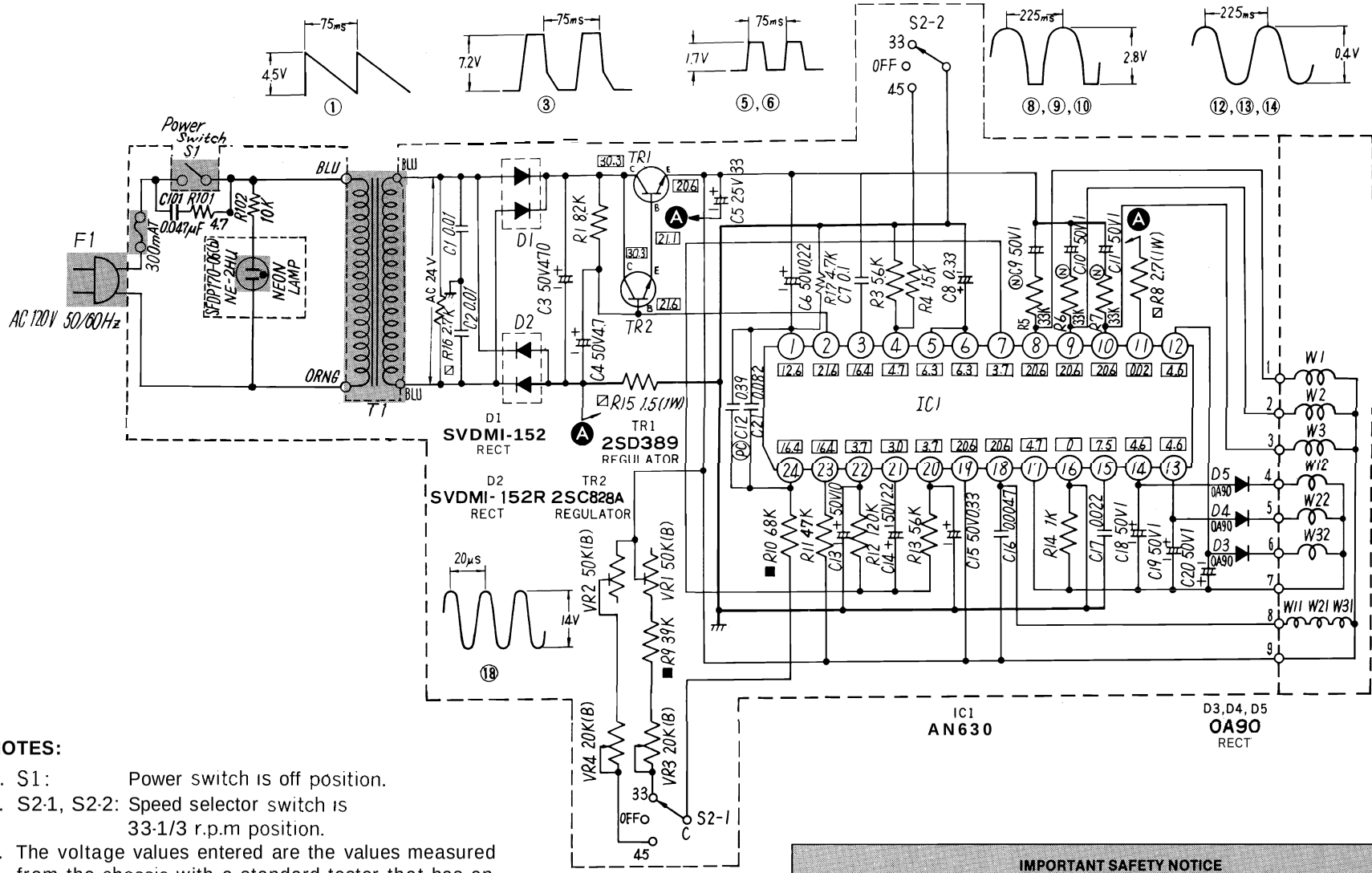
By means of the signal from the position signal coil, the starting circuit power transistor selector operates, obtaining smooth rotation.

Block diagram



Schematic Diagram

(This schematic diagram may be modified at any time with the development of new technology)



NOTES:

1. S1: Power switch is off position.
2. S2-1, S2-2: Speed selector switch is 33-1/3 r.p.m position.
3. The voltage values entered are the values measured from the chassis with a standard tester that has an internal resistance of 100KΩ/V at a rotational speed of 33-1/3 r.p.m.

IMPORTANT SAFETY NOTICE

THE SHADED AREA ON THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES IMPORTANT FOR SAFETY.
WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTUR'S SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS IN THE SHADED AREAS OF THE SCHEMATIC.

Circuit Board Wiring View

TR1 2SD389

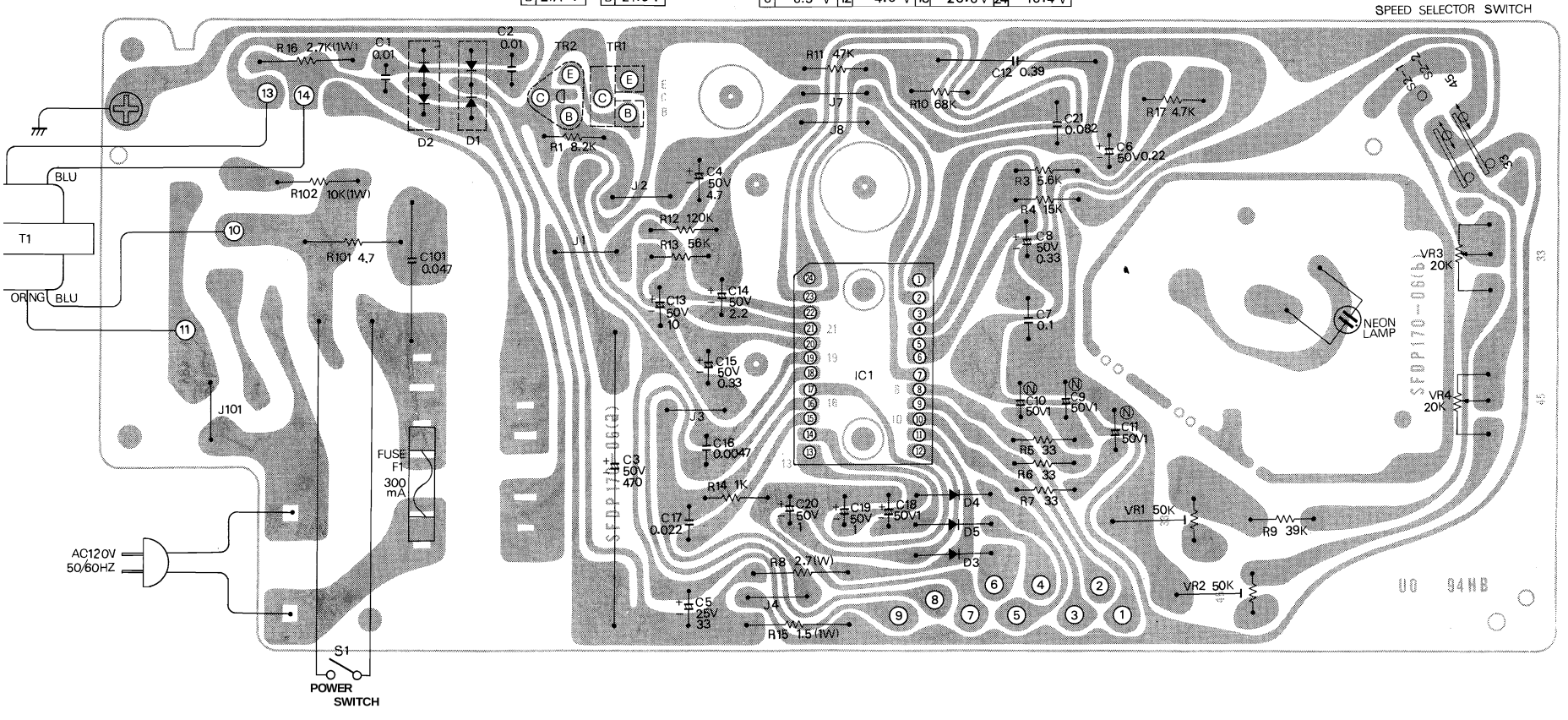
E	20.6V
C	30.3V
B	21.1 V

TR2 2SC828

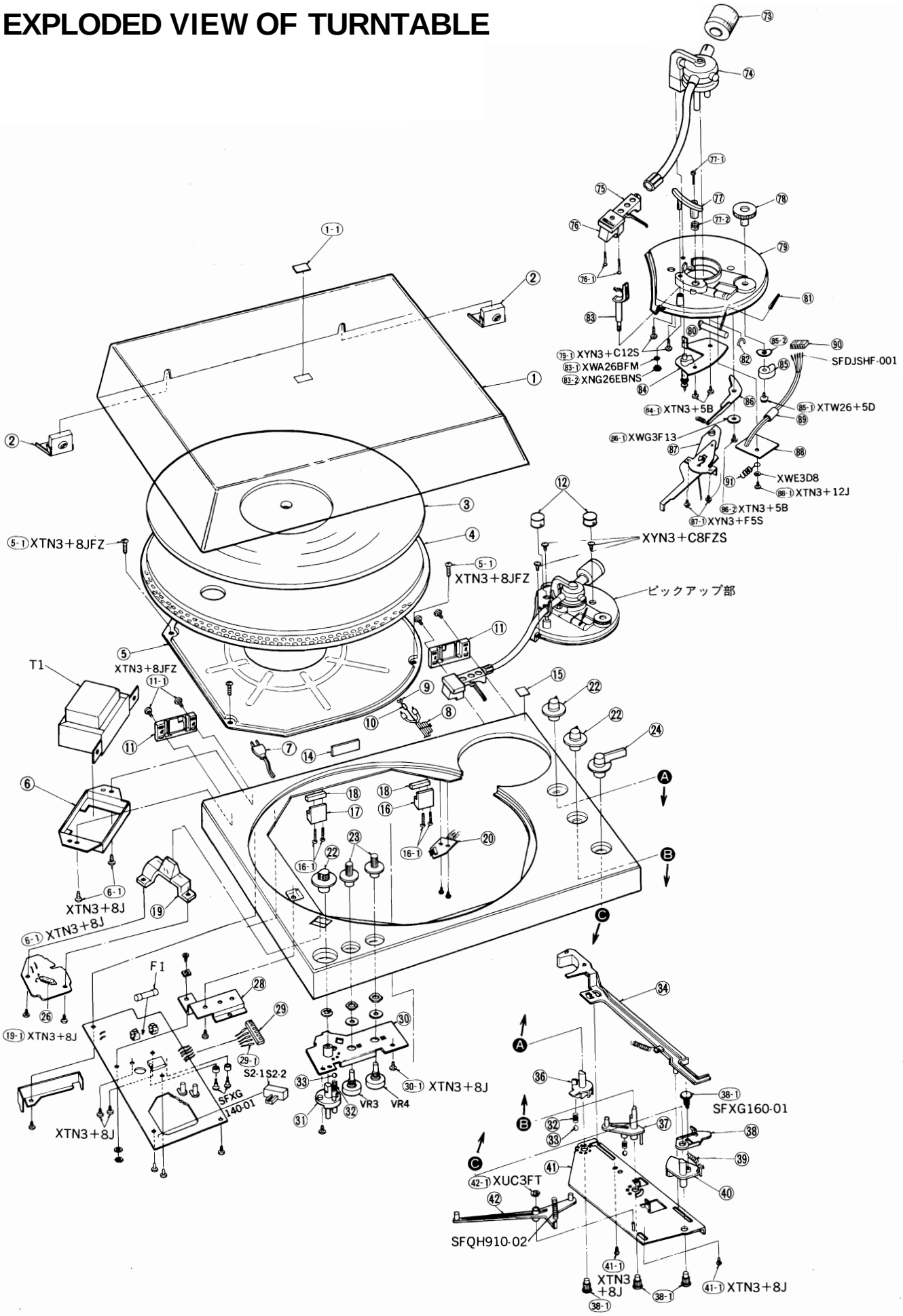
E	21.1 V
C	30.3 V
B	21.6 V

IC1 AN630

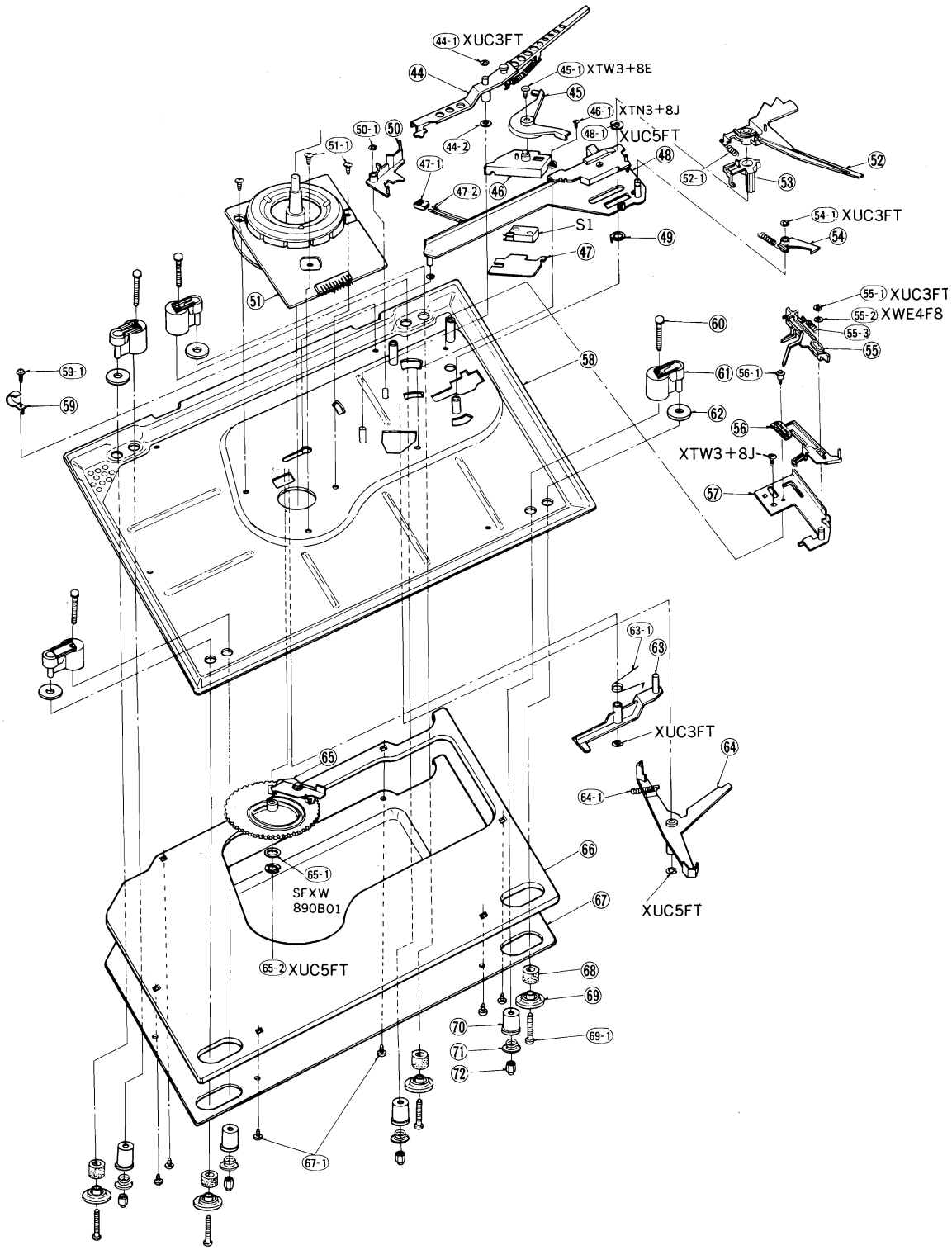
1	12.6 V	7	3.7 V	13	4.6 V	19	20.6 V
2	21.6 V	8	20.6 V	14	4.6 V	20	3.7 V
3	16.4 V	9	20.6 V	15	7.5 V	21	3 V
4	4.7 V	10	20.6 V	16	0 V	22	3.7 V
5	6.3 V	11	0.06 V	17	4.7 V	23	16.4 V
6	6.3 V	12	4.6 V	18	20.6 V	24	16.4 V



EXPLODED VIEW OF TURNTABLE



EXPLODED VIEW OF TURNTABLE



REPLACEMENT PARTS LIST

Important Safety Notice

Components identified by shaded area have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

NOTE: 1. Part numbers are indicated on most mechanical parts.
Please use this part number for parts orders.

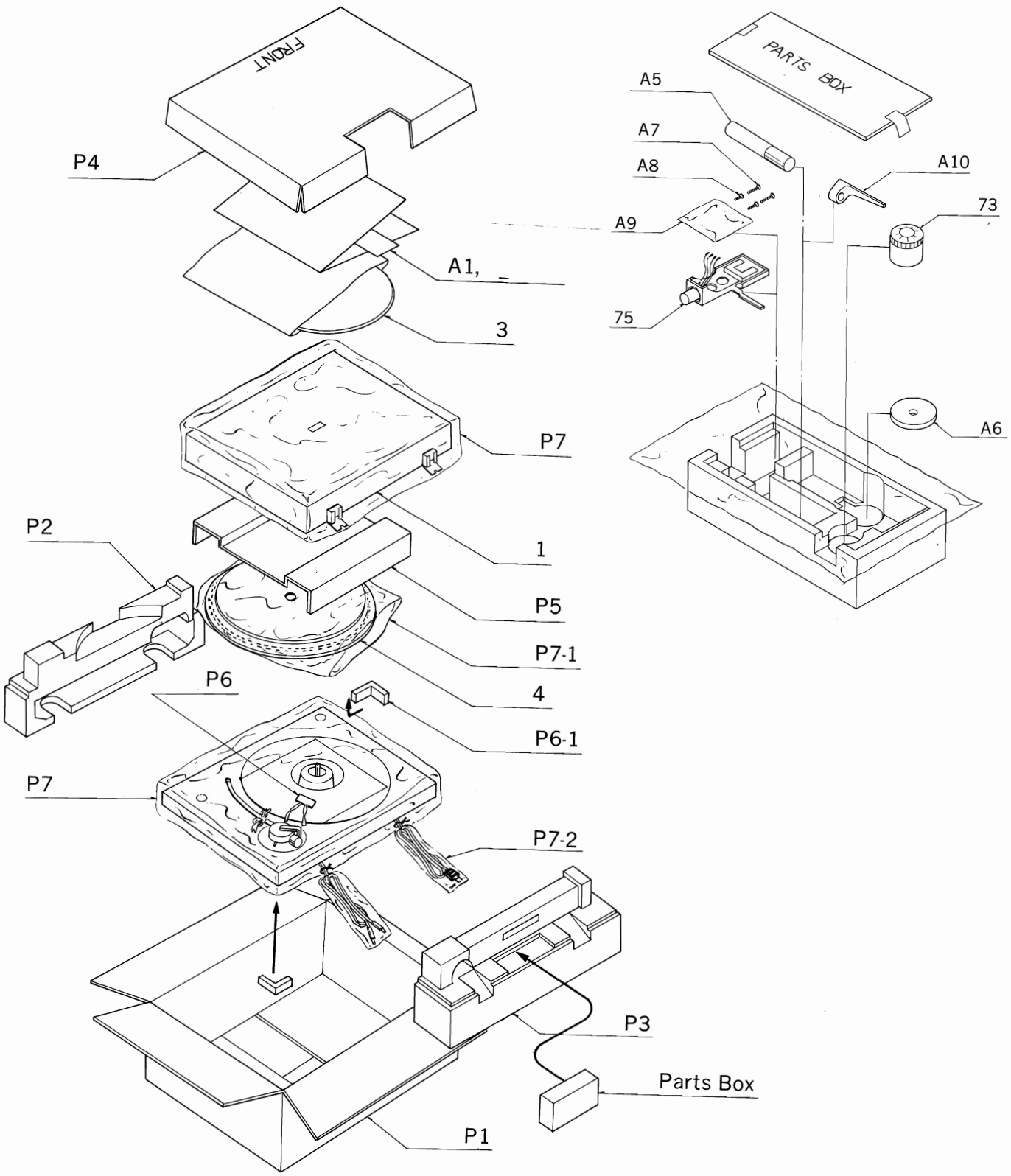
Ref. No.	Part No.	Part Name & Description	Per Set	Remarks
		INTEGRATED CIRCUIT		
IC1	AN630	Integrated Circuit	1	
		TRANSISTORS		
TR1	2SD389A-Q	Transistor	1	
TR2	2SC1328-T	Transistor	1	
		DIODES		
D1	RVD10DC2	Diode	1	
D2	RVD10DC2R	Diode	1	
D3, 4, 5	OA90	Diode	3	
		TRANSFORMER		
T1	SLT48EU9B	Power Transformer	1	○
		FUSE		
F1	XBA2F03NU100	0.3A (Fuse)	1	
		VARIABLE RESISTORS		
VR1, 2	EVLV3AS15B54	50KΩ, Pitch controls	2	
VR3, 4	EVHGMAF15B24	20KΩ, Speed adjustment	2	
		SWITCHES		
S1	SFDSAH76503	Micro Switch, Power	1	
S2-1, S2-2	SFDS160-02	Speed selector Switch	1	
		RESISTORS		
R1	**ERD25TJ822**	8.2KΩ, 1/4W, ± 5%, Carbon	1	
R3	**ERD25TJ562**	5.6KΩ, 1/4W, ± 5%, Carbon	1	
R4	**ERD25TJ153**	15KΩ, 1/4W, ± 5%, Carbon	1	
R5, 6, 7	**ERD25TJ330**	33Ω, 1/4W, ± 5%, Carbon	3	
R8	**ERX1ANJ2R7**	2.7Ω, 1W, ± 5%. Metallic	1	
R9	ERO25CKF3902	39KΩ, 1/4W, ± 1%. Metallic	1	
R10	ERO25CKF6202	68KΩ, 1/4W, ± 1%. Metallic	1	
R11	**ERD25TJ473**	47KΩ, 1/4W, ± 5%. Carbon	1	
R12	**ERD25TJ124**	120KΩ, 1/4W, ± 5%. Carbon	1	
R13	**ERD25TJ563**	56KΩ, 1/4W, ± 5%, Carbon	1	
R14	**ERD25TJ102**	1KΩ, 1/4W, ± 5%. Carbon	1	
R15	**ERX1ANJ1R5**	1.5Ω, 1W, ± 5%. Metallic	1	
R16	**ERG1ANJ272**	2.7KΩ, 1W, ± 5%, Metallic	1	
R17	**ERD25TJ472**	4.7KΩ, 1/4W, ± 5%, Carbon	1	
R101	**ERD50TJ4R7**	4.7Ω, 1/2W, ± 5%, Carbon	1	
R102	**ERG1ANJ103**	10KΩ, 1W, ± 5%, Metallic	1	

Ref. No.	Part No.	Part Name & Description	Per Set	Remarks
		CAPACITORS		
C1, 2	ECQM1H103KZ	0.01μF, 50WV, ±10%, Polyester	2	
C3	**ECEB50470**	470μF, 50WV, −10~+50%, Electrolytic	1	
C4	**ECEA504R7**	4.7μF, 50WV, ±20%, Electrolytic	1	
C5	**ECEA25V33**	33μF, 25WV, −10~+50%, Electrolytic	1	
C6	**ECEA50ZR22**	0.22μF, 50WV, ±20%, Electrolytic	1	
C7	ECQM1H104KZ	0.1μF, 50WV, ±10%, Polyester	1	
C8	**ECEA50ZR33**	0.33PF, 50WV, ±10%, Electrolytic	1	
C9, 10, 11	**ECEA50V1**	1μF, 50WV, ±10%, Electrolytic	3	
C12	ECQC2394KN	0.39μF, 200V, ±10%, Polyester	1	
C13	**ECEA50M10**	10μF, 50WV, ±20%, Electrolytic	1	
C14	**ECEA50M2R2R**	2.2μF, 50WV, ±20%, Electrolytic	1	
C15	**ECEA50MR33R**	0.33μF, 50WV, ±20%, Electrolytic	1	
C16	ECQM1H472KZ	0.47μF, 50WV, ±10%, Polyester	1	
C17	ECQM1H223KZ	0.022μF, 50WV, ±10%, Polyester	1	
C18, 19, 20	**ECEA50V1**	1μF, 50WV, ±10%, Electrolytic	3	
C21	ECQM1H823KZ	0.082μF, 50WV, ±10%, Polyester	1	
C101 [M]	ECQF1A473MD	0.047μF, 125V, ±20%, Polyester		
C101 [MC]	ECQU1A473MC	0.047μF, 125V, ±20%, Polyester	1	
		CABINET and CHASSIS PARTS		
1	SFAD170-01E	Dust Cover	1	
1-1	SFKK110	Badge, Dust Cover	1	
2	SFAT170-01A	Hinge Ass'y	2	
3	SFTG170M01	Turntable Mat, Set for [M]	1	
3	SFTG170-01	Turntable Mat, Set for [MC]	1	
4	SFTE170-01A	Turntable	1	
5	SFAU170-03	Panel Cover	1	
5-1	XTN3+8JFZ	Screw	4	
6	SFUP170-03	Bracket, Transformer	1	
6-1	XTN3+8J	Screw	2	
7	SPT1	AC Power Cord	1	
8	SFDH360M01	Phono Cord, Set for [M]	1	
8	SFDH028-01	Phono Cord, Set for [MC]	1	
9	SFEL028-01E	Ground Wire Ass'y	1	
11	SFUM170-07	Case, Hinge	2	
11-1	XTN3+8JFZ	Screw	4	
12	SFGK170-01	Rubber Cap	2	*
13	SFAC160M01	Player Case	1	○
14	SFNN160M01	Name Plate, Set for [M]	1	*○
14	SFNN160C01	Name Plate, Set for [MC]	1	*○
16	SFUM170-11	Clamper, Phono Cord	1	
16-1	XTN3+14TFZ	Screw	4	
17	SFUM170-05	Clarnper, AC Power Cord	1	
18	SFUM170-06	Spacer.AC Power Cord	1	
19	SFUM130-01	Base, Neon Lamp	1	
19-1	XTN3+8J	Screw	2	
20	SFDP170-03	P.C.B, Phono Cord	1	
20-1	XTN3+8J	Screw	2	
22	SFKT170-03E	Knob, Selector	3	
23	SFKT170-04E	Knob, Speed Adjustment	2	
24	SFKT170-01E	Knob, Start	1	
25	SJT345	Holder, Fuse	2	
26	SFDNE2HU	Neon Lamp	1	
29	SFDJ5047-09	Connector	1	
29-1	SFDJ2759	Terminal	1	
30	SFUP170-01E	Bracket, Variable Resistor	1	
30-1	XTN3+8J	Screw	2	
31	SFUM170-03	Cam, Selector	1	

Ref. No.	Part No.	Part Name & Description	Per Set		Remarks
32	SFQA130-11	Spring, Cam	1		
33	SFYB5-32	Steel Ball	1		
34	SFUM160-05	Starting Plate	1		○
35	SFQH910-11	Spring, Starting Plate	1		
36	SFUM160-06	Cam, Repeat	1		○
37	SFUM160-01	Cam, Selector	1		○
38	SFUM160-08	Cam, Start B	1		○
39	SFQH160-01	Spring	1		○
40	SFUM160-07	Cam, Start A	1		○
41	SFUK160-01E	Plate, Operation	1		○
41-1	XTN3+8J	Screw	2		
42	SFUM170-02	Cutting Plate	1		
42-1	**XUC3FT**	Circlip	1		
43	SFQH910-12	Spring, Catting Plate	1		
44	SFUB130-11E	Actuating Plate Ass'y	1		
44-1	**XUC3FT**	Circlip	1		
45	SFUM170-01	Lever, Cut	1		
45-1	XTW3+8E	Screw	1		
46	SFUM170-08	Cover, Micro Switch	1		
46-1	XTN3+8J	Screw	1		
47	SFUP170-06	Base, Micro Switch	1		
47-1	SFDJ2139-03	Connector	1		
47-2	SFDJ2478	Terminal	2		
48	SFUB160-01A	Operating Plate Ass'y	1		○
48-1	**XUC5FT**	Circlip	1		
49	SFXW130-13	Washer	1		
50	SFUM130-16	Support, Switch	1		
50-1	**XUC3FT**	Circlip	1		
51	SFMZ170-01Z	D.D. Motor	1		
51-1	XTN3+8J	Screw	3		
52	SFUM160-02	Index Plate Ass'y	1		○
52-1	SFQH160-02	Spring	1		○
53	SFUM160-03	Support, Index Plate	1		○
54	SFUM160-04	Lever, Repeat	1		○
54-1	**XUC3FT**	Circlip	1		
55	SFUM160-10	Plate, Sensing	1		○
55-1	**XUC3FT**	Circlip	1		
55-2	XWE4E8	Washer	1		
55-3	SFQH910-11	Spring	1		
56	SFUM160-09	Support, Start Plate	1		○
56-1	SFXG910-06	Screw	1		
56-2	XTN3+8J	Screw	1		
57	SFUK160-02E	Plate, Auxiliary Start Plate	1		○
58	SFUK170-01E	Plate, Main Base	1		
59	SFUP170-08	Clamper, Shield	1		
59-1	XTN3+8J	Screw	1		
60	XVG4C30	Hexagon Bolt	4		
61	SFUM170-10	Support, Insulation	4		
62	SFUZ170-02	Felt, Insulation	4		
63	SFUM130-23	Plate, Gear Setting	1		
63-1	SFQS130-11	Spring, Gear Setting	1		
63-2	**XUC3FT**	Circlip	1		
64	SFUM130-24	Lever, Switch	1		
64-1	SFQH910-05	Spring, Lever	1		
65	SFUG130-12A	Main Gear Ass'y	1		
65-1	SFXW890B01	Washer	1		
65-2	**XUC3FT**	Circlip	1		
66	SFGZ170-02	Rubber, Player Cace	1		
67	SFAU170-01	Bottom Cover	1		
67-1	XTW3+10VFZ	Screw	6		
68	SFGZ170-03	Damper, Insulation	1		

Ref. No.	Part No.	Part Name & Description	Per Set		Remarks
69	SFGA170-02A	Foot, Audio Insulation	4		
69-1	XTN4+30J	Screw	4		
70	SFGA170-01	Rubber, Insulation	4		
71	SFQC170-01	Spring, Cushion	4		
72	SFXG170-02E	Nut	4		
73	SFPWG15001K	Balance Weight Ass'y	1		
74	SFPAM17001K	Tone Arm Ass'y	1		
75	SFPCC13001K	Head Shell	1		
77	SFPRT17003K	Lift Ass'y	1		
77-1	SFXG829-1	Screw, Tone Arm Rest Adjustment	1		
77-2	SFQA829-03	Spring, Lift	1		
78	SFPJK17001	Knob, Anti-Skate Force Control	1		
79	SFPKD17001	Arm Base	1		
79-1	XYN+C12S	Screw	2		
80	SFPJL17007K	Cueing Lever	1		
81	SFPAB12002	Knob, Lift	1		
82	SFPGM20001	Rubber, Cueing	1		
83	SFPRT17001K	Arm Rest	1		
83-1	XWA26BFM	Washer	1		
83-2	XNG26EBNS	Nut	1		
84	SFPAB17001A	Arm Lift Base Ass'y	1		
84-1	XTN3+5B	Screw	2		
85	SFPJK17002	Cam, Canceler A	1		
85-1	XTW26+5D	Screw	1		
85-2	SFEW13005	Washer	1		
86	SFPSH17001	Lever, Canceler	1		
86-1	XWG3F13	Washer	1		
86-2	XTN3+5B	Screw	1		
87	SFPAB17005A	Plate, Tone Arm	1		
87-1	XYN3+F5S	Screw	2		
88-1	XTN3+12J	Screw	1		
89	SFGT829T02	Tube	1		
90	SFDJS5PSHF1	Connector, 5P	1		
91	SFPSP17003	Spring	1		
		ACCESSORY PARTS			
A1	SFNU160M01	Instruction Book, Set for [M]	1		○
A1	SFNU160C01	Instruction Book, Set for [MC]	1		○
A5	SFWO010	Oil	1		
A6	SFWE154A1	45 rpm Adaptor	1		
A7	SFPEV7800	Screw, Cartridge	2		
A8	SFCZV8800	Screw, Cartridge	2		
A9	SFYF05A06	Polyethylene Bag	1		
A10	SFKO135M01E	Overhang Gauge	1		
		PACKING MATERIALS			
P1	SFHP160M01	Carton, Set for [M]	1		○
P1	SFHP160C01	Carton, Set for [MC]	1		○
P2	SFHH170-01	Pad, Front	1		
P3	SFHH170-02	Pad, Rear	1		
P4	SFHD170-01	Pad, Top	1		
P5	SFHD170-02	Pad, Turntable	1		
P6	SFHS170-02	Spacer, Arm Base	1		
P6-1	SFHS170-01	Spacer, Panel	2		
P7	SFYF60A60	Polyethylene Bag	2		
P7-1	SFYF45A50	Polyethylene Bag	1		
P7-2	SFYF10A30	Polyethylene Bag	2		

■ PACKING PARTS



Printed in Japan.
7701-3,350A